

PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project Upstream migration of Pacific lampreys in the John Day River: behavior, timing, and habitat preferences	
BPA project number	20064
Contract renewal date (mm/yyyy)	
Multiple actions? (indicate Yes or No)	
Business name of agency, institution or organization requesting funding United States Geological Survey Biological Resources Division Columbia River Research Laboratory	
Business acronym (if appropriate)	USGS CRRL
Proposal contact person or principal investigator:	
Name Mailing address City, ST Zip Phone Fax Email address	James G. Seelye 5501a Cook-Underwood Rd Cook, WA 98605 509 538 2299 509 538 2843 jim_seelye@usgs.gov
NPPC Program Measure Number(s) which this project addresses 7.5F, 7.5F.1, and from the report proceeding from 7.5F.1: Status report of the Pacific lamprey (<i>Lampetra tridentata</i>) in the Columbia River basin (BPA Project Number 94-026), Section III - Recommended Research, Subsections A, B, and C (abundance studies, current distribution, and other habitat limiting factors, respectively).	
FWS/NMFS Biological Opinion Number(s) which this project addresses	
Other planning document references Wy-Kan-Ush-Mi Wa-Kish-Wit, 1995, Volume II. Recommended actions under Status Report of the Pacific lamprey (<i>Lampetra tridentata</i>) in the Columbia River Basin. Report (Contract 95BI39067) to Bonneville Power Administration, Portland, Oregon, 1995. Recommended actions under Pacific Lamprey Research and Restoration Annual Report 1996 and Annual Report 1997 (draft). Identified as a research need at the Columbia Basin Pacific Lamprey Workshop, October 1998.	
Short description Using radiotelemetry and tagged lampreys, we will determine timing and movement patterns of upstream migrating Pacific lampreys. Physical characteristics of overwintering and spawning habitats of Pacific lampreys in the John Day River Basin will be measured.	
Target species Pacific lamprey (<i>Lampetra tridentata</i>), upstream migrating phase	

Section 2. Sorting and evaluation

Subbasin Lower Mid-Columbia/John Day
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Evaluation Process Sort

CBFWA caucus		CBFWA eval. process		ISRP project type
X one or more caucus		If your project fits either of these processes, X one or both		X one or more categories
X	Anadromous fish		Multi-year (milestone-based evaluation)	Watershed councils/model watersheds
	Resident Fish		Watershed project eval.	Information dissemination
	Wildlife			Operation & maintenance
				New construction
				X Research & monitoring
				Implementation & mgmt
				Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
	Lamprey Research Projects
20065	Identification of lampreys

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
9402600	Pacific Lamprey Research and Restoration	Project 9402600 will provide technical assistance and assistance in the collection of adult lampreys. Proposed work will complement Project 9402600 by providing tools to use in the implementation and evaluation of restoration of lamprey populations in the Umatilla River .

Section 4. Objectives, tasks and schedules***Past accomplishments***

Year	Accomplishment	Met biological objectives?

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Establish adult Pacific lamprey migration behavior and timing and define overwintering and spawning habitat	a	Trap returning adults at Tumwater Falls; use radiotelemetry to determine lamprey movement patterns and ultimate disposition in

Obj 1,2,3	Objective	Task a,b,c	Task
			spawning habitat
		b	Describe overwintering and spawning habitat by examining characteristics of locations of radiotagged fish, including substrate, temperature, water velocity, water depth, gradient, amount of cover, and redd characteristics (size, substrate, depth in water column)

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measurable biological objective(s)	Milestone	FY2000 Cost %
1.a	01/2000	04/2003	Establish adult Pacific lamprey migration behavior and timing		65
1.b	01/2000	04/2003	Define adult Pacific lamprey overwintering and spawning habitat		35
				Total	100

Schedule constraints
Completion date March 2003

Section 5. Budget

FY99 project budget (BPA obligated):	\$
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FY2000 budget by line item

Item	Note	% of total	FY2000 (\$)
Personnel		24.1	72,000
Fringe benefits		7.7	23,000
Supplies, materials, non-expendable property	radiotelemetry equipment; sampling equipment	27.5	82,000
Operations & maintenance	boat operation and maintenance; communications	4.0	12,000
Capital acquisitions or improvements (e.g. land, buildings, major equip.)			
NEPA costs			
Construction-related support			
PIT tags	# of tags:		
Travel	vehicle lease; per diem costs for field work	6.7	20,000
Indirect costs		22.3	66,700
Subcontractor	Oregon State University (data analysis)	2.7	8,000
Other	Aerial radiotracking surveys	5.0	15,000
TOTAL BPA REQUESTED BUDGET			298,700

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount (\$)
CTUIR	technical advice and trapping adult lampreys	1.5	10,000
BRD	technical advice and supervision	2.3	15,000
OSU	technical advice and database describing habitats	50.5	330,000
Total project cost (including BPA portion)			653,700

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	275,000	50,000		

Section 6. References

Watershed?	Reference
	Beamish, R.J. 1980. Adult biology of the river lamprey (<i>Lampetra ayresi</i>) and the Pacific lamprey (<i>Lampetra tridentata</i>) from the Pacific coast of Canada. Canadian Journal of Fisheries and Aquatic Sciences 37:1906-1923.
	Beamish, R.J., and C.D. Levings. 1991. Abundance and freshwater migrations of the anadromous parasitic lamprey, <i>Lampetra tridentata</i> , in a tributary of the Fraser River, British Columbia. Canadian Journal of Fisheries and Aquatic Science 48:1250-1263.
	Close, D.A., M. Fitzpatrick, H. Li, B. Parker, D. Hatch, and G. James. 1995. Status report of the Pacific lamprey (<i>Lampetra tridentata</i>) in the Columbia River Basin. Report (Contract 95BI39067) to Bonneville Power Administration, Portland, Oregon.
	Hammond, R.J. 1979. Larval biology of the Pacific lamprey, <i>Entosphenus tridentatus</i> (Gairdner), of the Potlach River, Idaho. M.S. thesis. University of Idaho, Moscow.
	Hawkins, C.P., and 10 coauthors. 1993. A hierarchical approach to classifying stream habitat features. Fisheries 18(6):3-12.
	Jackson et al. 1998. Pacific Lamprey Research and Restoration. Annual Report 1996. DOE/BPA-9402600. Bonneville Power Administration. Portland, Oregon.
	Kan, T.T. 1975. Systematics, variation, distribution, and biology of lampreys of the genus <i>Lampetra</i> in Oregon. PhD dissertation. Oregon State University, Corvallis, OR. 194 pp.
	Northwest Power Planning Council. 1994.(ammended 1995) Columbia Basin Fish and Wildlife Program. Portland, OR.
	Platts, W.S., W.F. Megahan, and G.W. Minshall. 1983. Methods for evaluating stream, riparian, and biotic conditions. U.S. Forest Service General Technical Report INT-221.
	Pletcher, F.T. 1963. The life history and distribution of lampreys in the Salmon and certain other rivers in British Columbia, Canada. M.S. thesis, University of British Columbia, Vancouver, B.C. 195 p.
	Purvis, H.A., C.L. Chudy, E.L. King, Jr., and V.K. Dawson. 1982. Response of spawning-phase sea lampreys (<i>Petromyzon marinus</i>) to a lighted trap. :15-25.
	Richards, J.E. 1980. The freshwater life history of the anadromous Pacific lamprey, <i>Lampetra tridentata</i> . M.S. thesis, University of Guelph, Guelph, Ont. 99 p.
	Winter, J.D. 1983. Underwater biotelemetry. Chapter in Fisheries Techniques. American Fisheries Society. pp. 371-396.
	Wy-Kan-Ush-Mi Wa-Kish-Wit, 1995, Volume II:Subbasin Plans. Columbia River Inter-Tribal Fish Commission, Portland, OR.

PART II - NARRATIVE

Section 7. Abstract

Historic accounts and recent observations of Pacific lampreys (*Lampetra tridentata*) at mainstem Columbia River dams indicate the number of Pacific lampreys migrating upriver has decreased dramatically over the last 60 years. Consequently, state, federal, and tribal governments have recently expressed concern for this species. Little is known about the biological and ecological characteristics of habitats suitable for upstream migrating Pacific lampreys. However, knowledge of the factors limiting survival and reproduction of Pacific lampreys must be known to successfully rehabilitate depressed populations. Determining migration behavior, timing, and the resulting quantification of habitat preferences will provide a means to assess the suitability of overwintering and spawning habitats and allow the establishment of goals for recovery projects.

Section 8. Project description

a. Technical and/or scientific background.

Pacific lamprey (*Lampetra tridentata*) populations in the Columbia River Basin (CRB) have declined dramatically compared to their populations prior to hydropower development (Close et al. 1995). Consequently, state, federal, and tribal organizations have recently expressed concern for this species. For example, in 1993 the Oregon Department of Fish and Wildlife designated the Pacific lamprey at risk of being listed as threatened or endangered should its status continue to deteriorate. Similarly, the Pacific lamprey was designated as a Category 2 candidate species by the US Fish and Wildlife Service in 1994. Columbia River treaty tribes have also voiced concern about the decline of this culturally significant species (Close et al. 1995; Jackson et al. 1998). The Northwest Power Planning Council's Fish and Wildlife Program (1994) noted the apparent decline of Pacific lampreys and requested a status report to identify research needs. The resulting report (Close et al. 1995) called for studies on lamprey abundance, evaluation of their current distribution, and determination of habitat limiting factors. Rehabilitation is now being planned in some areas where lampreys are believed to have been extirpated (Close et al. 1995; Jackson et al. 1998).

Identification of the biological and ecological factors that may limit lamprey production is critical to population assessment and recovery efforts. Although some biological and ecological information for this and sympatric species (western brook lamprey *L. richardsoni* and river lamprey *L. ayresi*) is available from studies conducted in Canada (Pletcher 1963, Beamish 1980, Richards 1980, Beamish and Levings 1991), little is known of the biology and ecology of lampreys in the CRB (Kan 1975, Hammond 1979). Participants in the Columbia Basin Pacific Lamprey Workshop (Pendleton, OR October 1998) concluded that in addition to evaluating the population status of lampreys, fundamental biological questions must be answered, including identification of biological and ecological factors limiting lamprey production in the CRB.

Documentation of the life history strategy and habitat preferences of Pacific lampreys in streams and rivers tributary to the Columbia River will help identify factors limiting lamprey populations, identify areas in need of rehabilitation, and help to assess the efficacy of management actions. At present, we only have a cursory understanding of the life history pattern of Pacific lampreys. Pacific lampreys are believed to migrate into freshwater and move upstream to spawn from May-September, overwinter, and spawn in early spring the following year (Beamish 1980, Beamish and Levings 1991). Migration behavior and timing of Pacific lampreys in the CRB are presently unknown, including rate of movement through the mainstem Columbia River, timing of movement into tributaries, rate of movement in tributaries and habitat preferences during migration.

We propose to conduct this study in the John Day River Basin for several reasons. First, larval and adult stages of Pacific lampreys have been documented in the basin (Jackson et al. 1998; ODFW pers. comm.). Second, the John Day River is unimpounded and provides the opportunity to study migration behavior and timing of fish unimpeded by passage constraints. And third, since the John Day River Basin shares certain characteristics with the Umatilla River Basin, data collected during this study may be useful in the implementation and evaluation of the proposed restoration of Pacific lampreys in the Umatilla River. Migration behavior, timing, and the quantification of habitat preferences will provide a means to assess the suitability of overwintering and spawning habitat and help to establish goals for recovery projects.

Radiotelemetry is a well-established technique to evaluate migration behavior and timing in fishes (Winter 1983). Radiotelemetry is currently being used to assess adult lamprey passage at Bonneville Dam (NMFS, pers. comm.) and to examine Pacific lamprey homing behavior in the lower Columbia River by CRITFC (pers. comm.).

This proposed project would answer questions about Pacific lampreys posed by regional fishery managers. Specifically, the quantification of habitat needs will help managers to develop strategies that assure long-term population viability of Pacific lampreys. Data from this project would provide information necessary to examine

other aspects of lamprey biology and ecology, such as quantification of rearing habitat and determination of relative abundance of sympatric species of lamprey present in the CRB (river lamprey (*L. ayresi*) and western brook lamprey (*L. richardsoni*)).

b. Rationale and significance to Regional Programs

Sections 7.5F and 7.5F.1 of the NPPC Fish and Wildlife Program (1994) noted the apparent decline of Pacific lamprey in the CRB, and requested a status report that would identify research needs. Section three of the resulting report (Close et al. 1995) outlines these research needs (in part): section III.A, abundance studies; section III.B, current distribution; and, section III.D, determine habitat limiting factors. Close et al. (1995) also list the “identification of potential applications of transplantation” and “...artificial production” (section III.E and section III.F) as research needs.

We intend to work closely with personnel involved in Project #9402600. Findings from our proposed work will assist in implementation and evaluation of the restoration aspect of Project #9402600. This information will also be provided directly to regional tribal and state fisheries managers so they may take management actions necessary to assess lamprey populations and quantify habitat needs in the John Day River Basin and other areas.

c. Relationships to other projects

This project will complement ongoing and proposed lamprey research in the basin, by providing some of the basic life history information necessary to understand the needs of this species. We feel that coordination of research is very important and we intend to work with existing projects (9402600) and proposed projects (IDFG, USFWS) to standardize sampling methodologies. This would allow the comparison of information collected on different populations of lampreys in the CRB. We will also communicate and cooperate with watershed projects 9137 and 8402100 to keep other researchers in the basin apprised of our activities.

In particular, we believe this work can be directly applied to the implementation and evaluation of lamprey restoration efforts in the Umatilla River Basin (Project 9402600), since the Umatilla and John Day Rivers are close in proximity and somewhat similar in character. The principal investigators conducting 9402600 and this proposed work are cooperating to the greatest extent possible. We are currently providing assistance to CTUIR (Project 9402600) with their quantitative assessment of upstream migrating lampreys.

d. Project history (for ongoing projects)

e. Proposal objectives

1. Establish adult Pacific lamprey upstream migration behavior and timing and describe overwintering and spawning habitat in the John Day River Basin.

Hypotheses tested (H_0):

1. Movement of adult Pacific lampreys is consistent temporally in the John Day River Basin.
2. Distribution and habitat use of adult Pacific lampreys is consistent spatially and temporally in the John Day River Basin.

f. Methods

Objective 1

Assessment of movements of upstream migrating lampreys in the John Day River Basin will be done using radiotelemetry. Lampreys will be trapped in lighted box traps (Purvis et al. 1985) at Tumwater Falls (RKM 20). Trap design and placement will be reviewed by concerned officials to ensure that they will not interfere with the migrations of other fishes. All lampreys collected will be counted and identified to species. Biological data including length, weight, girth, sex, maturity, and overall condition will be recorded for all radiotagged fish. One hundred randomly selected adult Pacific lampreys will be radiotagged. Radiotags will be surgically implanted following procedures developed by NMFS (pers. comm.) and CRITFC (pers. comm.) in other lamprey radiotelemetry studies. We will attempt to capture and radiotag lampreys from May through October to represent the natural timing of the run. With each group of radiotagged lampreys, an additional 20 to 30 lampreys marked with florescent button tags in the dorsal fin will be released. Different color tags will be used for each release.

Radiotransmitters will be located a minimum of once per week until spawning is observed. Four fixed receivers will be used to record movements, one in the mainstem and one in each of the three major tributaries (North Fork, Middle Fork, and South Fork). Aerial surveys will be conducted weekly to determine approximate tag

locations. Mobile tracking by ground and by boat will be conducted to precisely locate each fish. Snorkel surveys for 50 meters upstream and downstream from each radiotaged fish will be conducted where conditions allow. Observations of button tagged lampreys will be recorded to supplement the observations of radiotagged lampreys. This technique will be particularly useful during spawning when lampreys are in shallow water and can be seen more easily.

Habitat usage will be determined by examination of fish locations. Monthly surveys of a subsample of fish locations will be conducted. Characteristics of fish locations will be recorded, including: habitat type (Platts 1983 ;Hawkins et al 1993) temperature, water velocity, gradient, water depth, substrate and amount of cover. We will also measure redd characteristics and will excavate a subsample of redds to evaluate false nesting. Spawning habitat use will be assessed by observing lamprey locations during the night and marking spawning areas for characterization during daylight hours.

Once we have characterized overwintering and spawning habitats, we will use Oregon State University's extensive habitat and temperature history database for the John Day Basin to identify other areas of the tributaries where similar habitats are located. These areas will be surveyed to see if lampreys are present.

g. Facilities and equipment

The Columbia River Research Laboratory is equipped with many of the resources necessary to successfully complete this project. Personnel with extensive experience in state of the art radiotelemetry research are available for assistance. Laboratory and office space and equipment, including desktop computers and software are available. In addition, we have a state of the art GIS computer system and software at the lab. A variety of field equipment and a fleet of vehicles and boats to 30' are available and in good working order.

The following list of items will need to be acquired. We will make every effort to borrow equipment before making purchases.

NECESSARY ITEMS:

- radiotelemetry equipment, including transmitters (100), fixed receivers (4), mobile receiver, antennas, cable, misc.
- laptop computer to download data from fixed receivers in the field
- GPS receiver to mark fish locations in the field

h. Budget

This project will require two years of field work. The budget presented for FY 2000 covers three quarters. The budget for FY 2001 includes the last quarter of work required for the first year of field work and three quarters of the second year of field work. Similarly, the budget for FY 2002 covers two quarters for completion of data analysis, report, and manuscript preparation.

Under the assumption that BPA will purchase directly from the supplier, no indirect costs have been included for the cost of most of the radiotelemetry equipment (transmitters, receivers, antennas; total = \$56,500). The amount budgeted for the purchase radiotelemetry equipment may be further reduced if we are able to borrow equipment from other researchers at the CRRL or elsewhere in the basin. We will make every effort to do so prior to making purchases.

Section 9. Key personnel

James G. Seelye--principal investigator for proposed work

Current Position: Supervisory Fishery Biologist, GS-14
Laboratory Director
Columbia River Research Laboratory
Cook-Underwood Road
Cook, Washington 98605

Education and Training:

Degree		Date	School
B.S.	Biological Science	1969	Lake Superior State College
M.S.	Limnology	1971	Michigan State University
Ph.D.	Limnology	1975	Michigan State University

Experience:

Research Limnologist, Project Manager, USACE, Waterways Experiment Station, 1975-1976
Supervisory Fishery Biologist (Research), Project Leader, FWS, Contaminant Dynamics, Great Lakes Fishery Laboratory, 1976-1982
Supervisory Fishery Biologist (Research), Station Chief, FWS, Hammond Bay Biological Station, 1982-1995
Supervisory Fishery Biologist, Director, USGS/BRD, Columbia River Research Laboratory, 1995 to present

Current Assignment: I am currently the Director at the CRRL, a major fishery research lab on the Columbia River. I have provided advice and assistance to lamprey researchers in the US and Canada for almost 20 years. Members of my staff and I are funded to conduct studies of the physiological effects of the fish bypass facilities at the Bonneville Dam. I provide advice and assistance to Dave Close with the CTUIR on their studies on a regular basis. I maintain a working relationship with the staff working on sea lampreys in the Great Lakes.

Selected Publications:

Seelye, J. G., L. L. Marking, E. L. King, Jr., L. H. Hanson, and T. D. Bills. 1987. Toxicity of TFM lampricide to early life stages of walleye. *North American Journal of Fisheries Management* 7:598-601.

Bergstedt, R. A., W. D. Swink, and J. G. Seelye. 1993. Evaluation of two locations for coded wire tags in larval and small parasitic-phase sea lampreys. *North American Journal of Fisheries Management* 13:609-6120.

Youson, Y. H., J. A. Holmes, J. A. Guchardi, J. G. Seelye, R. E. Beaver, J. E. Gersmehl, S. A. Sower, and F. W. H. Beamish. 1993. Importance of condition factor and the influence of water temperature and photoperiod on metamorphosis of sea lamprey, *Petromyzon marinus*. *Canadian Journal of Fisheries and Aquatic Sciences* 50:2448-2456.

Bergstedt, R. A., and J. G. Seelye. 1995. Evidence for lack of homing by sea lampreys. *Transactions of the American Fisheries Society* 124:235-239.

Fredricks, Kim T. and James G. Seelye. 1995. Flowing-recirculated water system for inducing spawning phase sea lampreys to spawn in the laboratory. *Progressive Fish Culturist* 57:297-301.

Jennifer M. Bayer--Team Leader for proposed work

Current Position:

Cooperative Education Agreement Student (Fishery Biologist)

US Geological Survey/Biological Resources Division

Columbia River Research Laboratory, Cook, WA 98605

(509) 538-2299 ext 273 Jennifer_Bayer@usgs.gov

Education:

Portland State University M.S. Biology, in progress (pending spring 1999)

Oregon State University B.S. Fisheries Science, 1993.

Experience:

1997-Present Cooperative Education Agreement Student, Columbia River Research Lab, Cook, WA & Portland State University, Portland, OR.

1994-1997 Fishery Biologist, USGS BRD Columbia River Research Laboratory.

1992-1994 Student Research Assistant, Stream Team, OSU, Corvallis, OR.

1991 Biological Technician, Northern Squawfish Predator Control Project, Dept. of Agricultural & Resource Economics, OSU, Corvallis, OR.

1990-1991 Work-study student, Oregon Cooperative Fishery Research Unit, OSU.

1989 Technician II, Normandeau Associates, Inc., Peekskill, NY.

1987-1988 Technician II, Prince William Sound Aquaculture Corporation, Cordova, AK.

Current Research Assignments:

I am currently working on several research projects involving lampreys. We will examine the swimming performance of adult Pacific lampreys and use electromyogram radiotelemetry to determine the effects of exhaustive stress in these fish. We are also presently examining morphometric characteristics of upstream migrating adult Pacific lampreys captured at Bonneville Dam. We are holding adult Pacific lampreys in our laboratory and intend to describe morphometric changes these fish undergo as they become sexually mature. I am also currently collaborating with the USFWS CRFPO on two projects: first, we are examining utility of PIT tags (survival and tag retention) in ammocoetes and recently metamorphosed lampreys; and second, we are evaluating reliability of ammocoete identification criteria by identifying and holding ammocoetes through metamorphosis.

Publications, reports, manuscripts, etc.:

Bayer, J.M. Morphometric investigation of early life history stages of Columbia River cyprinids. (Master's thesis in progress.)

Bayer, J.M. 1997. Use of image analysis for morphometric investigation of chiselmouth and northern squawfish larvae. Presentation to the American Fisheries Society, 21st Annual Larval Fish Conference, Seattle, WA.(chapter in thesis.)

David A. Close--cooperator, supplying lampreys and advice for proposed work

Education:

B.S. Fishery Resources, University of Idaho

M.S. Fisheries Science, Oregon State University, pending spring 1999

Experience:

Lamprey Project Leader, Confederated Tribes of the Umatilla Indian Reservation, Department of Natural Resources, Tribal Fisheries Program adding up to 8 years experience in fisheries. I have a total of four years experience with lamprey research and restoration.

Current Assignment:

I am the project leader for lamprey rehabilitation efforts in the Umatilla River. These efforts include working to obtain the basic information on Pacific lampreys to facilitate rehabilitation. The lamprey rehabilitation effort on the Umatilla River is intended as a demonstration project for other similar streams in the Columbia basin.

Reports and publications:

Close, D.A., M. Fitzpatrick, H. Li, B. Parker, D. Hatch, and G. James. 1995. Status report of the Pacific lamprey (*Lampetra tridentata*) in the Columbia River Basin. Report (Contract 95BI39067) to Bonneville Power Administration, Portland, Oregon.

Bruce A. McIntosh—will provide data and advice on habitat surveys

Current Position:

Research Associate

Department of Forest Science

Oregon State University, Corvallis OR 97331-3801.

(541) 750-7313 FAX: 758-7760 E-Mail: mcintosh@fsl.ortst.edu

Education:

B.S. - Wildlife Biology, University of Montana, Missoula, 1982

M.S. - Forest Ecology, Oregon State University, Corvallis, 1992

Ph.D. - Forest Ecology, Oregon State University, Corvallis, 1995

Experience:

Research Associate, Department of Forest Science, Oregon State University, 1995 - Present Research Assistant, Department of Forest Science, Oregon State University, 1992-1995.

Current position:

I am a Research Associate in the Department of Forest Science, College of Forestry, Oregon State University. The overall goal of my research is to further our understanding of the structure, function, and dynamics of the coupled terrestrial and aquatic ecosystems that comprise watersheds. I have been conducting research on riverine ecosystems and salmonid habitats in the Columbia River basin for the past nine years. My research has focused on historical changes in riparian and stream habitats, salmonid life history, and the use of remote sensing for stream and riparian research and monitoring. In addition, I have been involved in several assessments of eastside ecosystems for the Federal Government.

Publications:

C.E. Torgersen, D.M. Price, B.A. McIntosh, and H.W. Li. in press. Multiscale thermal refugia and stream habitat associations of chinook salmon in Northeastern Oregon. Ecological Applications.

Faux, Russell N., B.A. McIntosh, D.J. Norton, and J.R. Sedell. 1998. Thermal remote sensing of water temperature. Annual Report. U.S. Environmental Protection Agency, USDA Forest Service, and Bureau of Land Management. 88 p.

McIntosh, B.A. 1995. Historical changes in stream habitats in the Columbia River basin. Ph.D. dissertation. Corvallis, OR: Oregon State University. 175 pp.

McIntosh, B.A., J.R. Sedell, J.E. Smith, R.C. Wissmar, S.E. Clarke, G.H. Reeves, and L.A. Brown. 1994. Historical changes in fish habitat for select river basins of eastern Oregon and Washington. Northwest Science, 68 (Special Issue):36-53.

Torgerson, C.E., N.J. Poage, M.A. Flood, D.J. Norton, and B.A. McIntosh. 1996. Airborne thermal remote sensing of salmonid habitat for restoration planning in Pacific Northwest watersheds. In: Proceedings of Watershed 96, June 1996, Baltimore, MD. Water Environment Federation.

Section 10. Information/technology transfer

Results from this study will be disseminated in the form of annual reports of research, peer-reviewed journal publications, and oral presentations and briefings. This information will be provided to members of the Lamprey Work Group including, Oregon and Washington state agencies, Native American tribes, and the US Fish and Wildlife Service Lower Columbia River Fishery Resource Office, Vancouver, WA as well as biologists from other organizations conducting or proposing studies on lampreys.

Congratulations!